

ABSTRACT

An apparatus is disclosed which allows the hydrate formed in the hydrate formation region of a desalination fractionation apparatus to be cooled as it rises in the apparatus. This has the beneficial effect of increasing its stability at lower pressures and reducing the depth at which the hydrate will begin to dissociate. The present invention provides for more efficient management of the distribution of thermal energy within the apparatus as a whole by controlling the flow of water through the system -- particularly residual fluids remaining after hydrate forms -- such that it is substantially downward through the fractionation column and out through a lower portion thereof. Hydrate thus separates from the residual fluid at or nearly at the point of formation, which helps keep the hydrate formation region of the apparatus at a temperature suitable for the formation of hydrate and improves efficiency. Hydrate formation may be enhanced, thereby further improving efficiency, by pre-treating the water-to-be-treated so as to dissolve hydrate-forming gas in it, before further hydrate-forming gas is injected into the water-to-be-treated under conditions conducive to the formation of gas hydrate.